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SURVEY FORMAT INFLUENCES EVALUATING PUBLIC ATTITUDES TOWARD ARTHROPODS

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Abstract.—Four hundred visitors to the Arizona Sonora Desert Museum were interviewed to evaluate the effect of survey format, age, sex, and education on respondent answers. The effect of question presentation, an alternate method for arthropod identification, and educational information on attitudes toward arthropods was measured. Using two different ranking systems for respondents to rate their preferences for four arthropod groups produced similar mean responses, but different results dependent on the demographic variables of age and gender. Utilizing visual aids rather than names separated respondents who recognized the arthropod from those who recognized only the name.

Public knowledge and attitudes toward either specific insect pests, such as carpenter bees (Barrows, 1980), wood-infesting insects (Robinson, 1980), mosquitoes (Robinson and Atkins, 1983), and cockroaches (Wood et al., 1981; Zungoli and Robinson, 1985), lawn insects (Ravlin and Robinson, 1985), or arthropods in general (Bennett et al., 1983; Byrne et al., 1984; Levenson and Frankie, 1983) have been evaluated in different areas of the U.S. These surveys provide information on human interactions with arthropods. Some of the survey results have been used to design educational programs and materials (Robinson and Atkins, 1983; Robinson and Zungoli, 1985).

Generally, surveys concerning urban insect pests did not contain questions to test if structure and wording may have biased respondent answers. Surveyors may unconsciously word a question to obtain a desired answer (Sudman and Bradburn, 1982). Respondent attitudes toward arthropods may have been inaccurately represented if the attitude evaluation was based on a single question. In a survey conducted in California, New Jersey, and Texas, respondent attitudes toward insects were considered to be dependent on respondent age or ethnic background based on one question, "Are there any insects that you like?" (Levenson and Frankie, 1983). Questions assessing attitudes toward arthropods should be reworded and repeated within the survey to check bias in question presentation (Sudman and Bradburn, 1982).

Surveys have referred to insects by common name rather than showing respondents specimens or photographs of the insects. Respondents may associate names with specific insects which are different than the accepted common names. Wood et al. (1981) discussed substitutions in survey terminology in an attempt to match local names for cockroaches used by residents in public housing. In his

Table 1. Mean rating of animals from 0 to 100.

Animal	Mean[1]
Bald eagle	81.1 a
Horse	65.3 b
Butterflies	62.1 b
Deer	50.0
Bees	48.7 c
Coyote	41.8 c
Skunk	32.2 d
Spiders	26.5 de
Beetles	23.9 e

[1] Mean ratings followed by the same letter a–e are not significantly different at $F_{0.05}$ using ANOVA with a Scheffé test.

survey of damage caused by *Xylocopa virginica* (L.), Barrows (1980) mentioned some respondents apparently confused this carpenter bee with other hymenopterans.

Entomologists have proposed that public education is the key for acceptance of urban pest management programs (Zungoli and Robinson, 1985) and improvement of attitudes toward arthropods (Byrne et al., 1984). None of the surveys has evaluated changes in respondent attitudes or reactions toward specific arthropods after information was provided on these animals. This survey examines three aspects of attitude surveys about arthropods: 1) the effect of question presentation, 2) an alternate method for arthropod identification, and 3) educational content on respondent attitudes toward arthropods.

Materials and Methods

Survey site and method.—From September through December 1981, 400 visitors were interviewed at the Arizona-Sonora Desert Museum (ASDM), Tucson, Arizona. Trained interviewers randomly selected adult visitors entering the museum grounds to survey.

Survey.—Survey questions were written and pretested according to recommendations in the Interviewer's Manual (Anonymous, 1976). The survey format consisted of a person to person interview followed by a written questionnaire. During the interview, respondents were asked seven questions selected to evaluate survey techniques. Question presentation was assessed by using two rating systems for respondents to rate their preference for four kinds of arthropods (butterflies, bees, beetles, and spiders). Respondents numerically rated four kinds of arthropods and four vertebrates from 0 to 100. When a similar question was pretested for a nationwide survey, Carpenter and Blackwood (1979) found that respondents gave a deer a neutral rating of 50 points. Thus, a deer was assigned an arbitrary value of 50 in this survey. Respondents scored each arthropod group more or less than 50 depending on whether they liked it more or less than the deer. Respondents also descriptively rated the four arthropod groups, selecting one out of six phrases which best described how they related to each kind of arthropod. So I could evaluate the use of actual specimens rather than naming arthropods, respondents were asked to select the more dangerous arthropod from two unidentified live

specimens, a brown spider *Loxosceles* sp. and a millipede *Orthoporus* sp. The impact of educational information was assessed by recording respondent reactions to a large unfamiliar arthropod, the whip scorpion *Mastigoproctus giganteus* (Lucas), before and after it was identified as harmless. In the questionnaire, respondents answered 12 questions concerning their age, gender, occupation, residency, education, and number of Desert Museum visitations.

Data analysis.—All survey data were coded and analyses were performed using SPSS (Statistical Package for the Social Sciences) programs (Nie et al., 1975). Analysis of variance was used to test for significant differences among mean numerical ratings for the arthropods and vertebrates. Scheffé's test was used to separate the mean ratings. A chi-square test was used to test for association between the respondents' demographic variables and responses to the descriptive rating, dangerous arthropod, and whip scorpion questions.

Results and Discussion

Respondents were almost equally divided between men (48%) and women (52%) and averaged 44.5 ± 16.5 years in age (range 17–92 yr). Respondents were well educated; 77.5% had some level of college education. About 40% of the respondents were Arizona residents and 28% lived in Tucson. The remaining 60% were from 40 other states and 6 foreign countries. About half (49%) of the respondents lived in suburbs; the remainder were divided between urban (28%) and rural (22%) areas. Fifty percent of the interviewees had previously visited the ASDM at least once.

Each question is quoted from the survey, followed by discussion of the responses. The questions are not presented in the order in which they were asked during the interview, but are grouped to provide easier discussion of the results.

Question Presentation

"We would like to know how much you like different kinds of animals. We are going to assume that a deer is worth 50 points. As I read a list of animals, please tell me how many points from 0 to 100 you would give each animal to show how much you like it compared to a deer. For example, if you like an animal I name less than a deer, then give it less than 50 points. If you like the animal more than a deer, give it more than 50 points. Animals: coyote, butterflies, skunk, bees, horse, beetles, bald eagle, spiders."

Eagle received the highest average rating (81.1) which was significantly greater than the scores for horse (65.3) and butterflies (62.1, Table 1). Bees and coyote had intermediate scores, 48.7 and 41.8 respectively. Beetles received the lowest mean rating (23.9) which was significantly less than the score of the lowest rated vertebrate, skunk (32.2), but not significantly different from the score for spiders (26.5). In a similar question in a survey of Arizona residents, the bald eagle received the highest rating, butterfly and honey bee received median ratings, and garden spider was rated lower than skunk (Byrne et al., 1984).

"I am going to show you four different kinds of insects and related animals. As I show you each kind please select one of the following phrases (respondent was given a list of phrases) which best describes how you relate to each animal: 1) enjoy their presence, 2) tolerate them, 3) indifferent to them, 4) dislike them, 5)

Table 2. Respondent relationships to four arthropod groups.

Arthropod Group	Percentage Response				
	Enjoy	Tolerate	Indifferent	Dislike	Afraid
Butterflies	96.7	1.7	0.7	0.5	0.2
Bees	29.8	41.0	5.9	7.6	15.8
Beetles	10.2	42.7	19.1	24.9	3.1
Spiders	9.1	30.4	13.4	27.1	20.0

afraid of them, 6) other." (Interviewer named each arthropod group as specimens were pointed out in a display of preserved butterflies, beetles, bees, and spiders.)

The overall results of the descriptive (Table 2) and numeric (Table 1) rating systems are compatible. Butterflies were enjoyed by a majority of respondents (96.7%) and also received the highest numeric score for an arthropod (62.1). Bees were the second must enjoyed arthropod and second most feared arthropod. The polarity in response to bees indicates their intermediate numeric rating (48.7) may represent a compromise for respondents who appreciate bees but fear being stung. Spiders and beetles were the most disliked kinds of arthropods and received the lowest numeric scores, 26.5 and 23.9 respectively. Spiders received the highest percentage of negative responses; 27.1% of the respondents disliked them, and 20% were afraid of them. Beetles were the second most disliked type of arthropod, as rated by 24.9% of the respondents. In addition to many colorful beetles such as *Plusiotis gloriosa* LeConte (Scarabaeidae), the display contained several large beetles such as *Alaus oculatus* (Linn.) (Elateridae) and *Dynastes granti* Horn (Scarabaeidae) whose appearance may have disturbed respondents.

Both rating systems generally demonstrated similar attitudes toward arthropods dependent on gender and level of education (Table 3). Over 77% of the respondents had continued their educational studies beyond high school. College educated respondents, compared to respondents with only a high school education, tended to give spiders a significantly higher numeric rating, 28.5 vs. 21.0 respectively (ANOVA, $P = 0.001$; Scheffé test, $P < 0.05$) and enjoyed or tolerated spiders more in the descriptive rating, 43.6% vs. 24.7% respectively. Females, compared to males, demonstrated a greater dislike and fear of venomous arthropods by both rating systems. Women rated bees 7.5 points less and spiders 6.7 points less than men did. Similarly, about 11% more women compared to men were afraid of bees and 22.5% more were afraid of spiders. Men gave butterflies a significantly lower numeric rating than women did, 55.6 vs. 68.2 respectively (t test, $P < 0.0001$). There was no significant difference between the genders in their descriptive rating of butterflies ($\chi^2 = 5.71$, df = 4, $P = 0.22$).

The two rating systems did not demonstrate similar attitudes toward arthropods dependent on respondent age (Table 3). At the termination of the study, respondent ages were divided into three categories; under 36 yr (38.7%), 36 to 55 yr (29.8%), and over 55 yr (31.3%). Respondents under 36 yr rated bees significantly lower in numeric scoring than older respondents did (ANOVA, $P < 0.0001$; Scheffé test, $P < 0.05$). No significant differences between age classes were detected in the descriptive rating of bees ($\chi^2 = 10.07$, df = 8, $P = 0.26$). Similarly, 17.3% of the respondents under 36 yr disliked spiders, compared to 26.1% of the 36 to

Table 3. Respondent demographics and attitudes toward arthropods.

	Numeric Rating[1] (0–100)	Descriptive Rating[2] Enjoy (%)	Tolerate (%)	Indifferent (%)	Dislike (%)	Afraid (%)
Level of Education						
Spiders:						
High School (86)[3]	21.0	4.7	20.0	11.8	36.5	27.1
Some college (116)	26.3	9.6	31.6	14.0	21.9	22.8
College (88)	24.3	9.1	26.1	15.9	26.1	22.7
Graduate (92)	34.9	13.3	41.1	13.3	23.3	8.9
Gender						
Bees:						
Female (206)	45.0	24.1	40.4	5.4	8.0	21.2
Male (193)	52.5	35.4	41.8	6.3	6.3	10.1
Spiders:						
Female	23.2	7.4	26.0	10.3	25.5	30.9
Male	29.9	11.1	34.7	16.8	28.9	8.4
Age						
Bees:						
Under 36 (155)	41.3	25.5	45.6	7.4	6.7	14.8
36 to 55 (119)	51.5	33.1	35.6	8.5	6.8	16.1
Over 55 (126)	58.3	31.7	40.5	1.6	9.5	16.7
Spiders:						
Under 36	27.2	13.3	30.7	14.0	17.3	24.7
36–55	27.8	10.9	32.8	12.6	26.1	17.6
Over 55	24.5	2.4	27.8	13.5	39.7	16.7

[1] Mean ratings not in boxes are significantly different within subsets at $F_{0.05}$ using ANOVA. A subset is the listing of descriptive or numeric ratings of an arthropod group by a demographic category (level of education, gender, age).

[2] Mean ratings not in boxes are significantly different within subsets $\chi^2_{0.05}$.

[3] ( ) = sample size.

55 yr age bracket and 39.7% of the over 55 yr age group. There were no significant differences between age classes in the numeric rating of spiders (ANOVA, $P = 0.52$). Based on one question, Levenson and Frankie (1983) concluded people who liked insects were generally younger. In this study, different perspectives of age class attitudes toward arthropods were obtained dependent on question presentation.

Arthropod Identification

"Which of these two animals would you consider more dangerous and why?" (Respondents were shown a millipede, *Orthoporus* sp., and a brown spider, *Loxosceles* sp.)

The majority (74.9%) of the respondents considered the spider more dangerous. A poisonous bite or sting was cited by most respondents as the reason for their selection. Respondent selection and identification of the arthropods were independent of level of education ($\chi^2 = 3.07$, df = 6, $P = 0.80$). Responses were generally not based on accurate knowledge of these arthropods. Only 9% of the

respondents correctly identified the spider as a relative of the brown recluse spider, *Loxosceles reclusa* Gertsch and Mulaik. Respondents apparently confused the millipede with a centipede (14 interviewees actually called it a centipede). Due to lack of knowledge, most respondents appeared to select a dangerous arthropod based on its appearance. The small size and mobility of the spider disturbed some respondents, who expressed opinions that spiders could creep up and bite them without being seen. Conversely, the large size of the millipede frightened other respondents, who thought the millipede looked more dangerous or vicious than the spider.

Respondent decisions were significantly related to residency ($\chi^2 = 15.10$, df = 2, $P = 0.0005$) and number of previous visits to the ASDM ($\chi^2 = 15.04$, df = 2, $P = 0.0005$). A higher percentage of Arizona residents (15.2%) and return visitors (14.7%) correctly identified the brown spider compared to nonresidents (4.5%) and new visitors (3.3%). Venomous arthropods and reptiles receive wide public exposure in Arizona through radio, television, newspapers, and publications of the University of Arizona and the State Poison Control Center. This may explain why more Arizona residents and return visitors recognized the brown spider.

Educational Content

"What would you do if you found this animal in your house?" (Respondent was shown a live whip scorpion, *Mastigoproctus giganteus*.)

A whip scorpion was selected to evaluate how people react when confronted with a large, unfamiliar arthropod. At the termination of the study, respondent answers were coded into four categories: killing, removing, saving, or not knowing what to do. Nearly 32% of the respondents would have killed the whip scorpion. Respondents were generally explicit about who would kill the animal (respondent, relatives, friends, professional exterminators) and how it would be done (physical or chemical methods). About 44% of the interviewees would have removed the whip scorpion, placing it outside the home. Respondents usually described who would remove the animal and how it would be done. All respondents would have avoided physical contact with the whip scorpion while removing it by scooping it into a container or sweeping it out the door. Over 13% of the respondents would have saved the whip scorpion to have it identified, keep as a pet to observe and photograph, or donate to local organizations like zoos, museums, schools, scouts, or 4-H clubs. Over 10% of the respondents did not know what they would do upon encountering the whip scorpion and generally appeared distressed when shown the animal.

"This animal (whip scorpion) is harmless to humans. It doesn't sting or have a dangerous bite. Knowing this information, now what would you do if you found this animal in your house?"

Supplying information on the whip scorpion changed the reaction of the respondents toward this arthropod. Compared to the initial response, 21.5% fewer respondents would have killed the whip scorpion (10.1% total) and 29.4% more of the respondents would have removed the animal (73.7% total). Twelve percent of the respondents would have saved the animal and 4% were still undecided.

Respondent reaction to the whip scorpion was significantly related to level of education, gender, and age (Table 4). Upon encountering the whip scorpion, a

Table 4. Respondent demographics and reaction to whip scorpion before and after information.

	Respondent Reaction to Whip Scorpion[1]			
	Kill (%)	Remove (%)	Save (%)	Other (%)
Level of Education				
Before information:				
High School	37.6	28.2	15.3	18.8
Some college	28.1	40.4	18.4	13.2
College	33.3	49.4	10.3	6.9
Graduate school	29.7	59.3	9.9	1.1
Gender				
Before information:				
Females	28.9	39.3	12.4	19.4
Males	34.7	49.7	14.0	1.6
After information:				
Females	9.4	74.9	8.9	6.9
Males	10.9	72.9	15.1	1.0
Age				
Before information:				
Under 36	25.7	46.7	17.1	10.5
36 to 55	28.2	49.6	13.7	8.5
Over 55	42.1	36.5	8.7	12.7
After information:				
Under 36	12.1	73.2	14.8	[2]
36 to 55	8.8	73.7	17.5	
Over 55	10.3	84.6	5.1	

[1] Mean ratings are significantly different at $\chi^2_{0.05}$ within subsets. A subset is the listing of reactions, before or after information, of a demographic category (level of education, gender, age).

[2] Percentages were less than 5% and were not used in the χ^2 analysis.

higher percentage of college educated respondents would have removed the animal and a lower percent would have killed it, saved it, or been indecisive compared to the reaction of high school level graduates. After information on the whip scorpion was supplied, level of education was no longer correlated with respondent reactions to the animal.

Men reacted more decisively than women when initially confronted with the whip scorpion. Only 1.6% of the men compared to 19.4% of the women did not know what they would do with the whip scorpion. After learning that the whip scorpion is harmless, the majority of both men and women would have removed the animal. However, 6.9% of the women compared to 1.0% of the men reacted indecisively.

Upon the first encounter with the whip scorpion, at least 14% more of the respondents over 55 yr compared to younger individuals would have killed the whip scorpion. Learning that the whip scorpion is harmless reduced and equalized the percentage of individuals in each age group who would have killed the animal. Only about 2% more of the respondents over 55 yr compared to younger respondents would have killed the whip scorpion. A higher percentage of respon-

dents over 55 yr wanted to remove the whip scorpion from their presence. About 10% more of these respondents would have transferred the animal outdoors, and 10% less would have saved it compared to respondents in the younger age brackets.

Conclusion

Results of this survey indicate urban entomologists should consider recommendations when designing and implementing sociological surveys. Key questions assessing attitudes toward specific arthropods should be reworded and repeated within the survey to check bias in question presentation. Desert Museum respondents were asked to rate four arthropod groups numerically in comparison to four vertebrates and descriptively in reference to preserved specimens. The two rating systems yielded similar mean responses, but different results dependent on the demographic variables of age and gender.

Instead of referring to specific arthropods by common name, the interviewer should show respondents photographs or specimens of the animals. The percentage of ASDM interviewees who correctly or incorrectly identified the brown spider and millipede was accurately determined by showing respondents live specimens. In addition, numerous ASDM respondents who did not recognize the brown spider later remarked that they heard of the brown recluse but didn't know how to identify one. Utilizing visual aids rather than names apparently screens out respondents who can recognize the name but not the actual arthropod.

By providing educational information, surveys may determine the receptiveness of respondents to modify their actions and attitudes toward particular arthropods. Results of this survey demonstrate education may improve public attitudes and reactions toward arthropods. Providing information on the whip scorpion significantly altered the reactions of ASDM respondents to this animal because 21% fewer respondents would have killed the whip scorpion after learning about it. In addition, college educated individuals were more tolerant toward arthropods than were high school level graduates. Some entomologists have suggested that individuals receiving more formal education might be more receptive to learning about urban arthropods (Byrne et al., 1984). Results of this survey indicate this assumption may be inaccurate. Level of education was not significantly related to responses requiring knowledge of specific arthropods (brown spider and millipede) or reaction to the whip scorpion after information was supplied. In fact, a higher percentage of high school level graduates compared to college graduates would have saved the whip scorpion, indicating their desire to learn about the animal.

Urban entomologists need to design surveys carefully to avoid biasing respondent answers. Following the suggested recommendations should enhance the accuracy of the survey data and improve the effectiveness of education programs based on survey results.

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